



I²C 10-bit ADC With On-Chip Temperature Sensor

AD7416/AD7417/AD7418

FEATURES

10-bit ADC with 20 μ s Conversion Time
I²C interface
On-Chip Temperature Sensor
-55°C to +125°C
On-Chip Reference (2.5V \pm 1%)
2.7V to 5.5V Power Supply
3.5 μ W Power Consumption at 10sps
Automatic Power Down After Conversion
Over Temperature Interrupt Pin
8-pin microSOIC package (AD7416/AD7418)
10-pin microSOIC package (AD7417)

APPLICATIONS

Ambient Temperature Monitoring
Data Acquisition Systems With Ambient Temperature Monitoring
Digital Demodulation

GENERAL DESCRIPTION

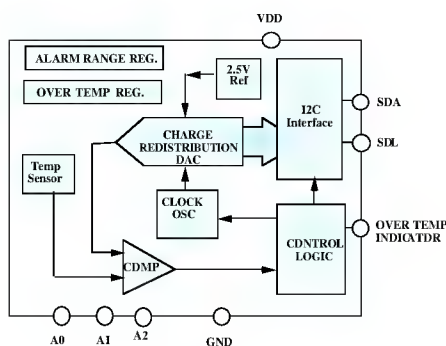
The AD7416/AD7417/AD7418 are analog to digital converters with an on-chip temperature sensor and 2.5V reference. The AD7416 address can be selected using A0, A1 and A2. These pins set the 3 LSBs of the device address. The AD7418 allows an external reference to be applied and allows access to the ADC function, AIN input pin, which can accept signals from 0V to V_{ref}. The AD7417 has a four channel AIN multiplexer. An over temperature interrupt pin and on-chip digital register allows the user to

program a set point. This can be used to provide an alarm function when the temperature exceeds the selected value. The value in the alarm range register selects the value, below which, the interrupt will become inactive. The I²C interface makes these parts ideal for a wide range of applications including thermal management in personal computers. The AD7417 and AD7418 has a CONVST pin which allows the user to determine the sampling instance of the previously selected analog input channel or temperature sensor. If the CONVST function is not required, it should be connected low, in which case a conversion is initiated directly after a change occurs in the multiplexer selected, or every 355 μ s, whichever occurs first. The conversion result can be read from at any time.

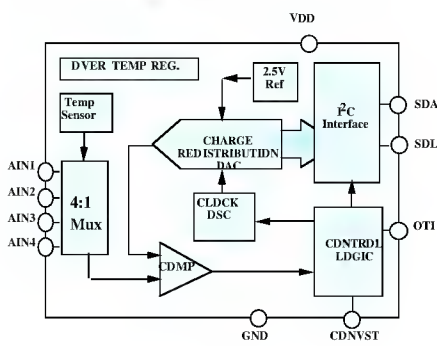
PRODUCT HIGHLIGHTS

1. These devices have On-Chip Temperature Sensors which allows an accurate measurement of the ambient temperature ($\pm 1^\circ\text{C}$ @ 25°C , $\pm 2^\circ\text{C}$ over temperature) to be made. An over temperature interrupt is implemented by carrying out a digital comparison of the ADC code with the contents of the On-Chip Over Temperature Register.
2. The automatic power down features enables the user to perfectly tune the power to achieve the lowest possible power consumption at their selected throughput rate.
3. The 8-pin microSOIC package, which is roughly 50% of the size of an 8-pin SOIC, minimises board space.

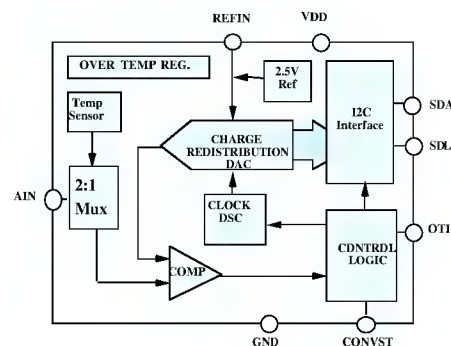
FUNCTIONAL BLOCK DIAGRAM



AD7416



AD7417



AD7418

Rev A.1

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AD7416/AD7817/AD7418

AD7416/AD7417/AD7418- SPECIFICATIONS¹ ($V_{DD} = +2.7V$ to $+5.5V$, $GND = 0V$, $REF_{IN} = +2.5V$.)

Parameter	A Version -40°C to +85°C	A Version -55°C to +125°C	B Version -40°C to +85°C	Units	Test Conditions/Comments
DYNAMIC PERFORMANCE					
Signal to (Noise+Distortion) Ratio ²	58	58	58	dB min	Sample Rate = 100kSPS, Any Channel f _{IN} = 20KHz fa = 48 kHz, fb = 48.5 kHz f _{IN} = 20kHz
Total Harmonic Distortion ²	-66	-66	-66	dB max	
Peak Harmonic or Spurious Noise ²	-66	-66	-66	dB typ	
Intermodulation Distortion ²					
2nd Order Terms	-67	-67	-67	dB typ	
3rd Order Terms	-67	-67	-67	dB typ	
Channel-to-Channel Isolation ²	-80	-80	-80	dB typ	
DC ACCURACY					
Resolution	10	10	10	Bits	Any Channel
Minimum Resolution for Which No Missing Codes are Guaranteed	10	10	10	Bits	
Relative Accuracy ²	±1	±1	±1	LSB max	
Differential Nonlinearity ²	±1	±1	±1	LSB max	
Gain Error ²	±2	±2	±2	LSB max	
Gain Error Match ²	±1/2	±1/2	±1/2	LSB max	
Offset Error ²	±2	±2	±2	LSB max	
Offset Error Match	±1/2	±1/2	±1/2	LSB max	
ANALOG INPUTS					
Input Voltage Range	V _{REF} 0	V _{REF} 0	V _{REF} 0	V max V min	
Input Leakage Current	±1	±1	±1	µA max	
Input Capacitance	10	10	10	pF max	
TEMPERATURE SENSOR ¹					
Operating Range	+85 -40	+125 -55	+85 -40	°C max °C min	External Reference V _{REF} = 2.5V On-chip Reference
Measurement Error					
Ambient Temperature 25°C	±2	±2	±1	°C max	
T _{MIN} to T _{MAX}	±3	±3	±2	°C max	
Measurement Error					
Ambient Temperature 25°C	±2	±2	±1	°C typ	
T _{MIN} to T _{MAX}	±3	±3	±2	°C typ	
Temperature Resolution	1/4	1/4	1/4	°C/LSB typ	
REFERENCE INPUT ^{3,4}					
REF _{IN} Input Voltage Range ⁴	2.625 2.375	2.625 2.375	2.625 2.375	V max V min	2.5V + 5% 2.5V - 5%
Input Impedance	50	50	50	kΩ min	
Input Capacitance	10	10	10	pF max	
ON-CHIP REFERENCE					
Reference Error ³	±25	±25	±25	mV max	Nominal 2.5V
Temperature Coefficient ³	50	50	50	ppm/°C typ	

Parameter	A Version -40°C to +85°C	A Version -55°C to +125°C	B Version -40°C to +85°C	Units	Test Conditions/Comments
LOGIC INPUTS⁵					
Input High Voltage, V_{INH}	2.4	2.4	2.4	V min	$V_{DD} = 5V \pm 10\%$
Input Low Voltage, V_{INL}	0.8	0.8	0.8	V max	$V_{DD} = 5V \pm 10\%$
Input High Voltage, V_{INH}	2	2	2	V min	$V_{DD} = 3V \pm 10\%$
Input Low Voltage, V_{INL}	0.4	0.4	0.4	V max	$V_{DD} = 3V \pm 10\%$
Input Current, I_{IN}	± 3	± 3	± 3	μA max	Typically 10nA, $V_{IN} = 0V$ to V_{DD}
Input Capacitance, C_{IN}	10	10	10	pF max	
LOGIC OUTPUTS⁵					
Output High Voltage, V_{OH}	4	4	4	V min	$I_{SOURCE} = 200 \mu A$ $V_{DD} = 5V \pm 10\%$
Output Low Voltage, V_{OL}	2.4	2.4	2.4	V min	$V_{DD} = 3V \pm 10\%$
	0.4	0.4	0.4	V max	$I_{SINK} = 200 \mu A$ $V_{DD} = 5V \pm 10\%$
High-Impedance Leakage Current	± 10	± 10	± 10	μA max	$V_{DD} = 3V \pm 10\%$
High-Impedance Capacitance	15	15	15	pF max	
CONVERSION RATE⁵					
Track/Hold Acquisition Time	400	400	400	ns max	Source Impedance < 10 Ω
Conversion Time					
Temperature Sensor	20	20	20	μs max	
Channels 1 to 4	20	20	20	μs max	
POWER REQUIREMENTS					
V_{DD}	+5.5	+5.5	+5.5	V max	For Specified Performance
	+2.7	+2.7	+2.7	V min	
I_{DD}					Logic Inputs = 0V or V_{DD}
Normal Operation	1.0	1.0	1.0	mA typ	
Using External Reference				mA max	2.5V external reference connected
Power Down	1.0	1.0	1.0	μA max	500nA typically
NOTES					

1